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ENGINEERED PROPERTIES IN CERAMIZED OPTICAL FIBRES

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Development of new luminescent ion (LI) –doped optical fibre devices require materials with « augmented » intrinsic properties, though using silica as host glass. Transparent glass ceramics (TGC) are then considered as they can combine the sturdiness and low cost of silica and particular spectroscopic behaviour that would not appear in a pure silica local-environment. Our presentation deals with optical fibres with TGC core. Dielectric nanoparticles (DNP) would optimally fully encapsulate LI to tentatively produce « engineered » spectroscopic properties. This technology will be of great interest for a large domain of applications: high power fibre lasers, random lasers, light sources with new wavelength, telecommunications…

The original route proposed by LPMC to obtain DNP-doped fibres is based on the industrial MCVD process. As silicate systems have a strong stable immiscibility when they contain divalent metals oxides, we take advantages of thermal treatments inherent to this process to obtain DNP through the phase separation mechanism. Through this route, DNP are grown in-situ within the material. Regarding environmental and health considerations, this is of great interest to avoid handling of and exposure to nanoparticles.

DNP are observed in fibres when alkaline-earth elements (Mg, Ca and Sr) are incorporated. Mean size of the DNP, deduced from SEM pictures, depends on the composition : it is around 100 nm in the case of Ca- and Sr-based DNP while it decreases down to 40 nm for Mg ones. This last composition leads to a low loss fibre : an attenuation of 0.4 dB/m at 1300 nm was measured, compatible with applications. From EDX measurements, we have observed that alkaline-earth elements and erbium ions are located inside or very close to the DNP. Fibre samples were spectroscopically analysed at room temperature. It was observed that erbium emission broadens in the DNP-doped fibres, which is also encouraging for possible future applications.

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